INTEGRATED DESIGN PROJECT SMJP 3303 & MONOZUKURI SMJP 4103 MACHINE DESIGN

BY

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As technology continues to drive forward, **design** is reaching a new tipping point

Design as a way to solve problems, discover opportunities, and create new objects and experiences, is reaching more people and equipping them with remarkable tools to make a better world.

What's exciting to see is that emerging digital tools are actually making it possible for more people, in more situations, to design well

The questions that swirl around the idea of design

How does design change our lives for the better?

How is our capacity to produce good design evolving?

How will be the next generation of designers work – and on what?

How do we define and better appreciate it, in hopes that we can encourage nurture more of it?

ASSESSMENT - REPORT

- Please compile the IDPreport as well

Guideline for report

- Introduction
  - Problem statement
  - Objective
- Design Process, Engineering Analysis and Fabrication Process
  - Product design specification
  - Conceptual design
  - Design selection and evaluation
  - Engineering analysis
  - Final design with engineering drawing

Report IDP

- Fabrication process
  - Machining part from engineering drawing
  - Assembly process
  - Electrical hardware /circuit assembly /diagram
- Testing evaluation and optimization
  - Testing and data gathering
  - Modification and optimization
- Costing detail and project management review (reflect back with the Gantt chart)
- Conclusion

MONOZUKURI

BASIC PROCEDURE OF MACHINE DESIGN

1 – RECOGNITION OF NEED

2 – MARKET SURVEY

3 – DEFINE SPECIFICATION OF PRODUCT

4 – FIND ALTERNATIVE MECHANISM FOR PRODUCT

5– SELECTION OF PROPER MECHANISM

6– LAYOUT OF CONFIGURATION

7– METHOD OF ASSEMBLE INDIVIDUAL ELEMENTS

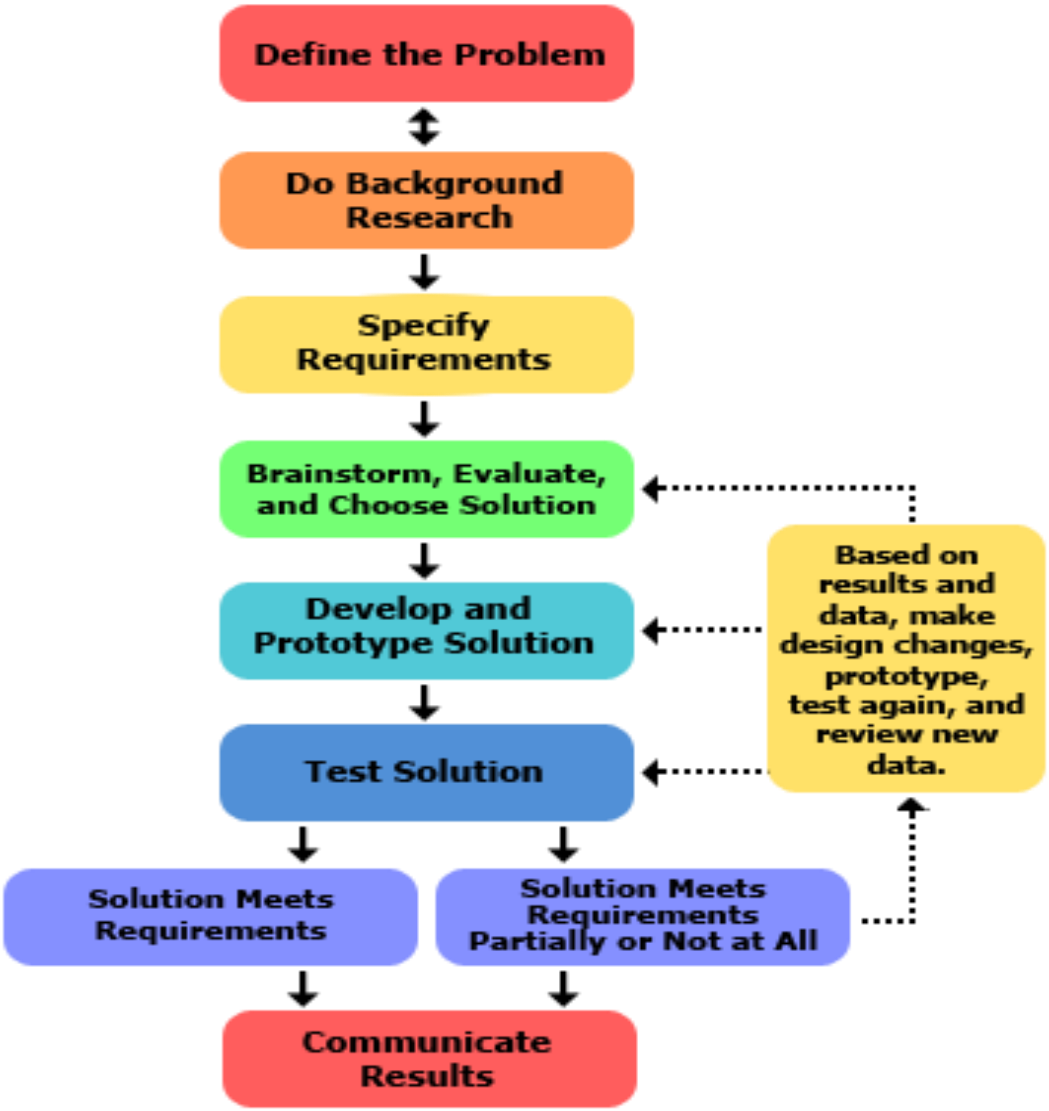
8–INDIVIDUAL COMPONENT DRAWING

9–DETAILED DRAWING

10–MODIFICATION

11– TESTING PROTOTYPE

FLOW CHART OF DESIGN PROCESS



1- RECOGNITION OF NEED

- What Is The Requirement Of Product

2- MARKET SURVEY

- Product design is worth
- Can manufacture the product or can buy the different element of product and simply assemble them
- Cost factor and etc.

3- SPECIFICATION OF PRODUCT

- Complete specification of product
- Ex: designing a motorbike - Overall dimension, weight, cost, fuel consumption, reliability, appearance, performance etc.

4- MECHANISM OF PRODUCT

- Basically The Internal Working Of Machine, how many and to make it works

5- SELECTION OF MECHANISM

- From all alternative – have to find the best for practice on the basic of manufacturing, cost reliability, availability raw materials, standard parts etc.

6- GENERAL LAYOUT OF CONFIGURATION

- General layout of selected methods consist of details of each and every part and its location

7- SELECTION OF METHOD OF ASSEMBLY

- Must specify the methods of assembly which require to integrate all elements – joints, screws, nut, bolt etc

8- INDIVIDUAL COMPONET DRAWING

- Criteria of individual components such stress, rigidity, natural of working, failure and etc.

9- DETAILED DRAWING

- Drawing of individual and assembly which includes different factors of dimensions, materials, tolerance, manufacturing process, surface finish, grades, machining symbols and other outsources needed etc.

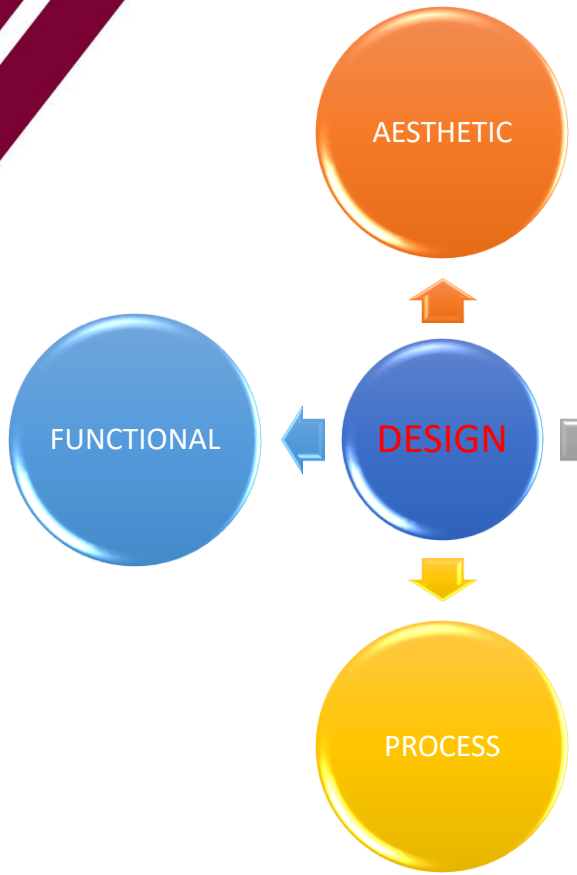
9 - MODIFICATION

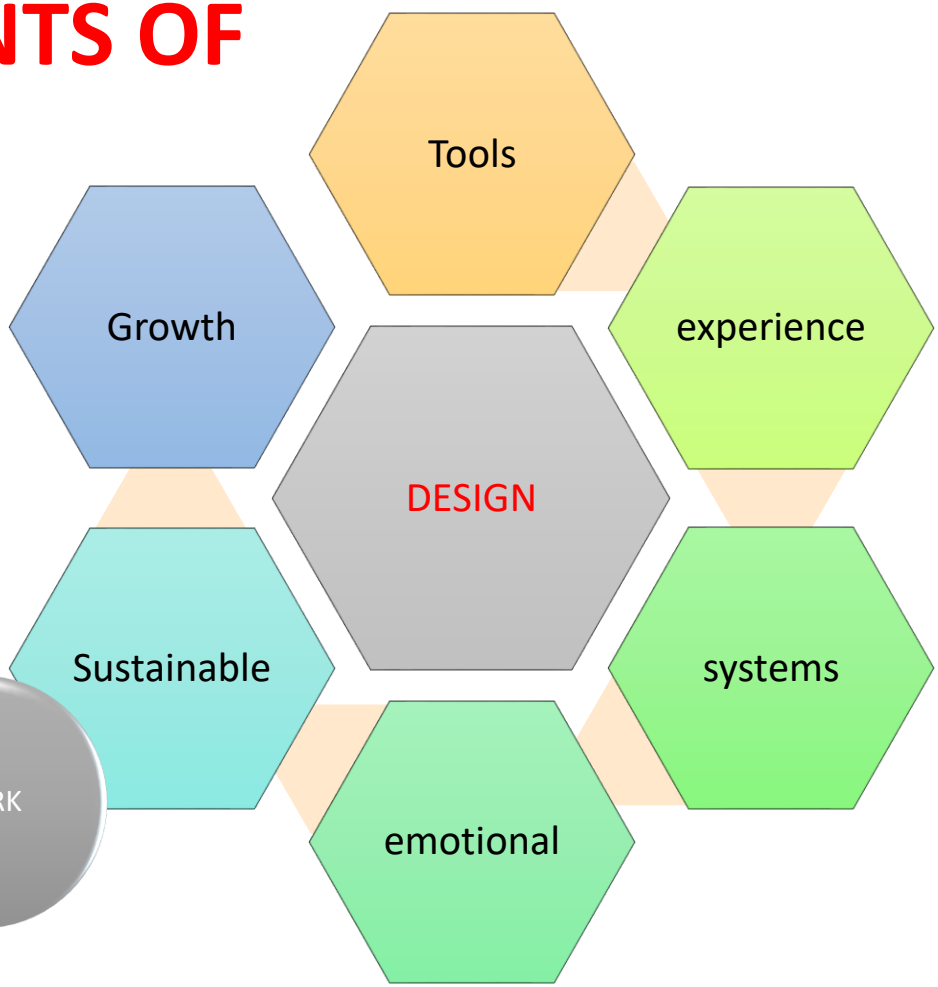
- Done as per specification however if at manufacturing occurred problems then modifications needed to manufacture back

10- PROTOTYPE TESTING

- Last process of the design.
- After this process the product will be finalized

ELEMENTS OF DESIGN



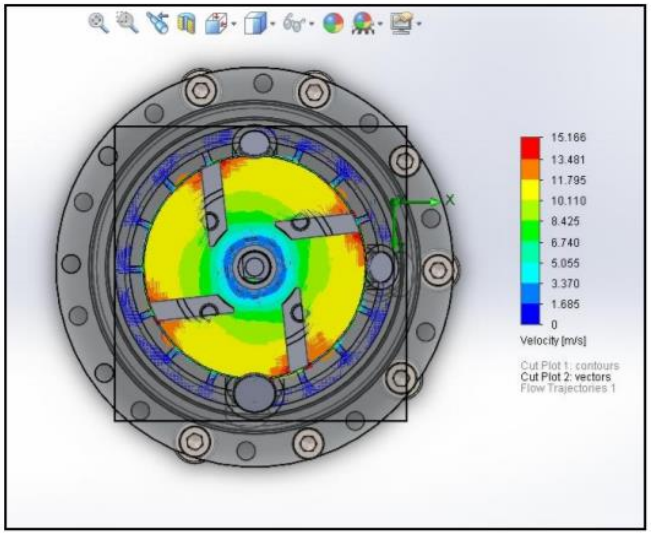


TEN ESSENTIALS OF GOOD DESIGN

Compulsory to provide

- Design Process:
  - Conceptual design
  - Design selection and evaluation
  - Final conceptual design
- Engineering analysis (must have at least one from the list)
  - Analysis related to selection of component and material
  - Analysis related strength of the part
  - Simulation flow, heat, kinematic and dynamic motion
- Engineering Drawing
  - Exploded view
  - Bill of material
  - Drawing for every parts
  - Detail specification of component (example : DC motor)
- Budget cost planning

Engineering analysis



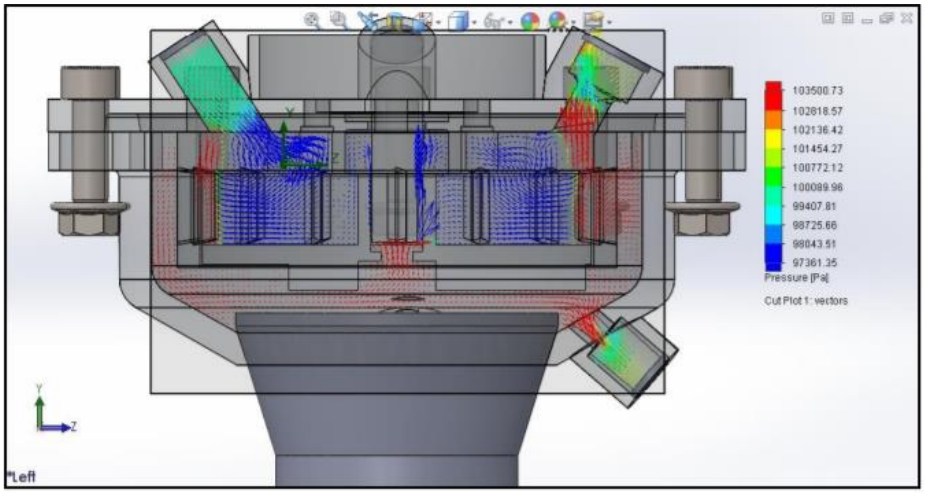


Table 5.10 Estimated maximum torque inside the mixing chamber under varied speed

Rotor speed, Rpm	Maximum torque, Nm
1000	0.036572153
2000	0.064228699
3000	0.10643827
4000	0.165627568
5000	0.343678095

Selection of DC motor

DC MOTOR

40W

□80mm(3.54in.)

Motor Specification

Model 8DCG□-40-30 : Pinion Shaft Type 8DCD□-40-30 : D-Cut Shaft Type	Output		Rated V	No Load		Rated Load					Starting Cur.	Starting Torque		
				Current	Speed	Current	Speed	Torque						
	HP	W	VDC	A	RPM	A	RPM	gfcm	mN.m	oz-in	A	gfcm	mN.m	oz-in
8DCG(D)12-40-30			12	1.2	3300	4.8					35	12000	1200	170
8DCG(D)24-40-30	1/19	40	24	0.4	3150	2.5	3000	1300	130	18.44	30	20000	2000	284
8DCG(D)90-40-30			90	0.18	3350	0.48					10	23000	2300	326

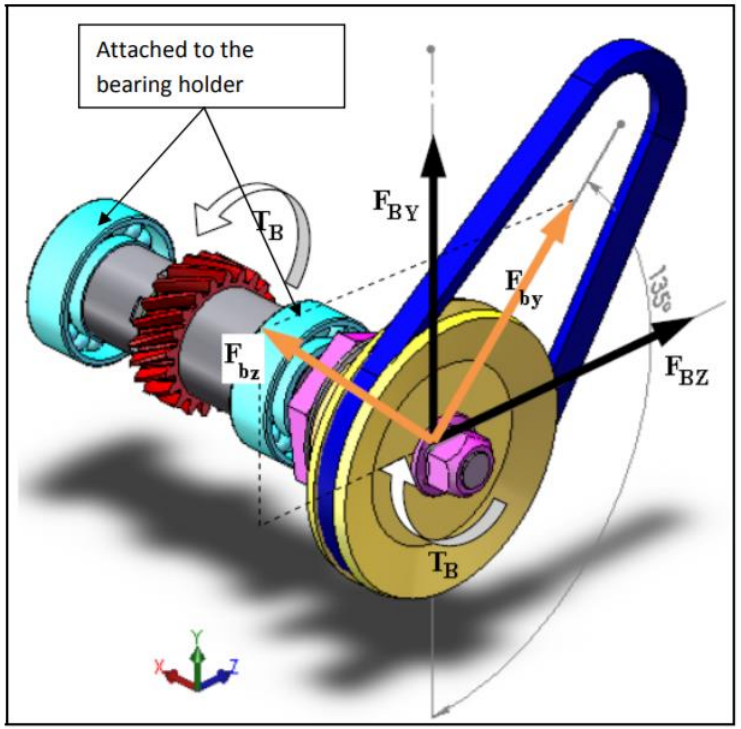
* 'Pinion Shaft' is for attaching gearhead and 'D-Cut Shaft' is for using motor only.

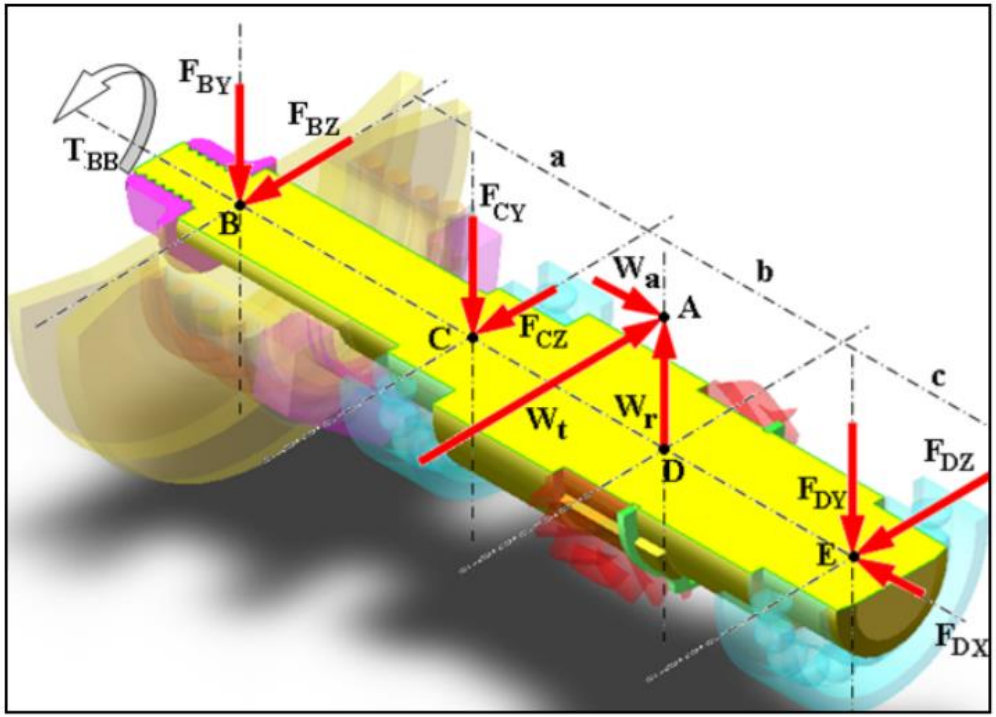
Permissible Torque When using gearhead

Model	speed RPM (r/min)		1,500	1,000	833	600	500	400	333	300	240	200	167	120	100	83.3	75	60	50	40	33.3	30	25	20	16.7	15	12	10	8
Motor/Gearhead	Gear Ratio		**2**	**3**	**3.6**	**5**	**6**	**7.5**	**9**	**10**	**12.5**	**15**	**18**	**25**	**30**	**36**	**40**	**50**	**60**	**75**	**90**	**100**	**120**	**150**	**180**	**200**	**250**	**300**	**360**
8DCG□-40-30 / **8GBK□BMH**		kgf·cm	2.6	3.9	4.7	6.5	7.8	9.7	11.7	13.0	16.2	19.5	23.4	32.5	39.0	46.7	51.9	64.9	77.9	80	80	80	80	80	80	80	80	80	80	80
		N.m	0.26	0.39	0.47	0.65	0.78	0.97	1.17	1.3	1.6	1.9	2.3	3.2	3.9	4.7	5.2	6.5	7.8	8	8	8	8	8	8	8	8	8	8	8
		lb-in	2.3	3.4	4.1	5.7	6.9	8.6	10.3	11	14	17	21	29	34	41	46	57	69	71	71	71	71	71	71	71	71	71	71	71

- Enter the phase & voltage code in the box (□) within the motor model name.
- Enter the gear ratio in the box (□) within the gearhead model name. A colored background indicates gear shaft rotation in the same direction as the motor shaft ; a white background indicates rotation in the opposite direction.
- The speed is calculated by dividing the motor' s synchronous speed (50Hz : 1500 r/min, 60 Hz : 1800 r/min) by the gear ratio.
- The actual speed is 2~20% less than the displayed value, depending on the size of the load.
- If more slow speed is needed than above value, use decimal gearhead with a gear ratio of 10:1 could be used between general gearhead and motor. Even in this case, just speed will be reduced without increase in permissible torque; the maximum permissible torque is 100kgfcm (10N.m, 88lb-in).

Engineering analysis

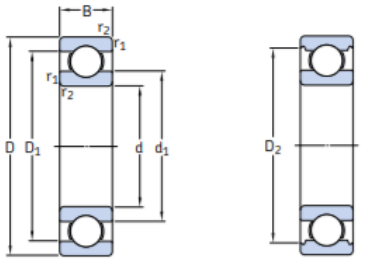




Example: Bearing Selection

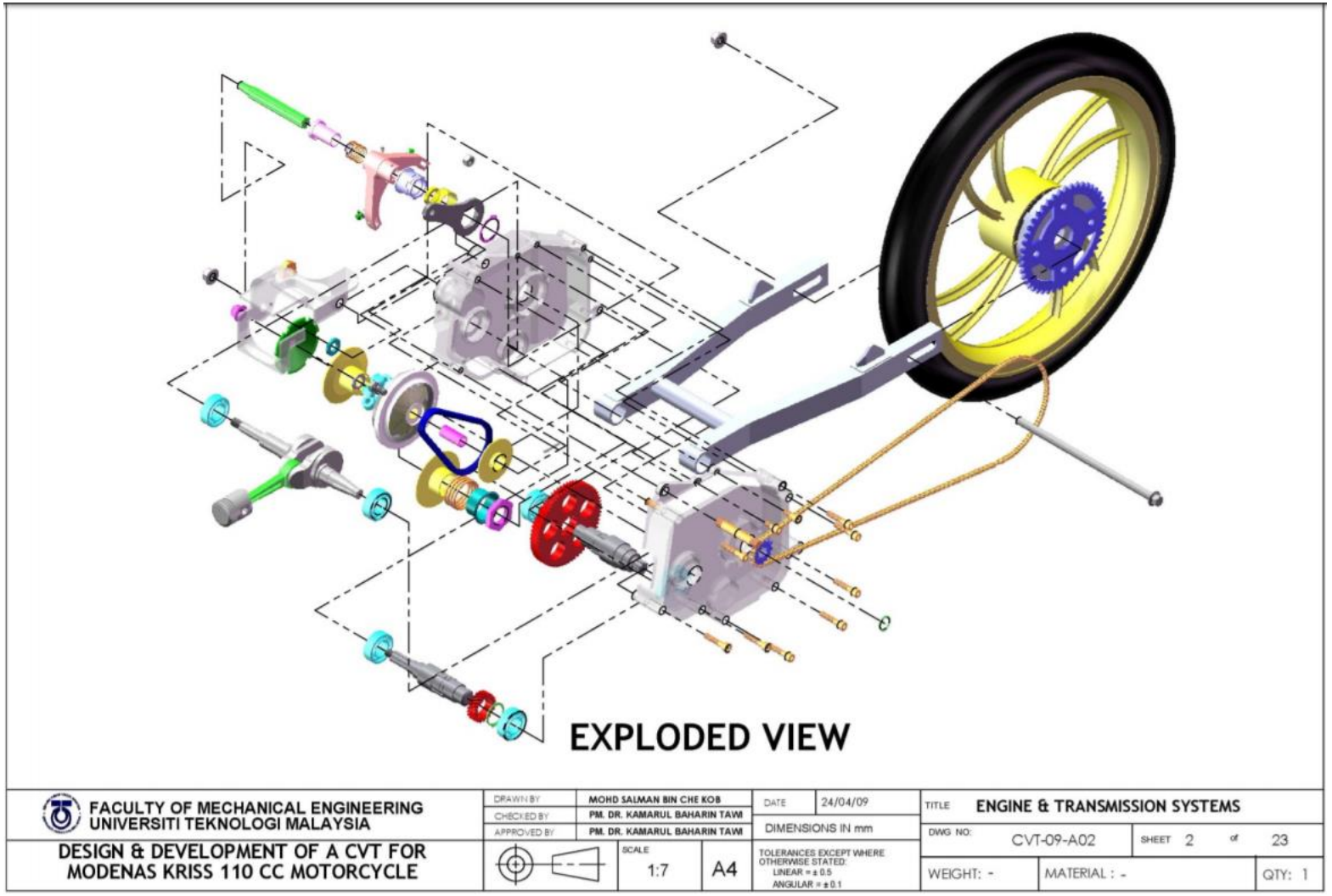
1.1 Single row deep groove ball bearings

d **80 – 100** mm

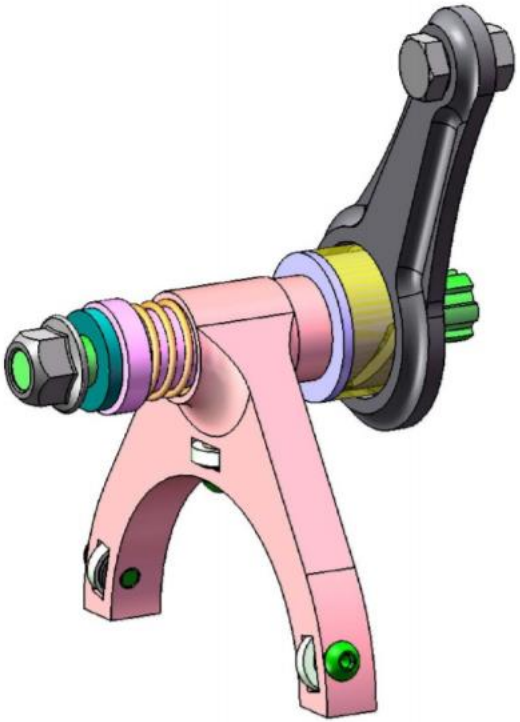


Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
80	100	10	13	15	0,64	13 000	8 000	0,15	**61816**
	110	16	25,1	20,4	1,02	12 000	7 500	0,38	**61916**
	125	14	35,1	31,5	1,32	11 000	7 000	0,61	* **16016**
	125	22	49,4	40	1,66	11 000	7 000	0,87	* **6016**
	140	26	72,8	55	2,2	9 500	6 000	1,45	* **6216**
	170	39	130	86,5	3,25	8 500	5 300	3,65	* **6316**
	200	48	163	125	4,5	7 500	4 800	6,85	**6416**
85	110	13	19,5	20,8	0,88	12 000	7 500	0,27	**61817**
	120	18	31,9	30	1,25	11 000	7 000	0,55	**61917**
	130	14	35,8	33,5	1,37	11 000	6 700	0,64	* **16017**
	130	22	52	43	1,76	11 000	6 700	0,92	* **6017**
	150	28	87,1	64	2,5	9 000	5 600	1,8	* **6217**
	180	41	140	96,5	3,55	8 000	5 000	4,25	* **6317**
	210	52	174	137	4,75	7 000	4 500	8,05	**6417**
90	115	13	19,5	22	0,915	11 000	7 000	0,28	**61818**
	125	18	33,2	31,5	1,29	11 000	6 700	0,59	**61918**
	140	16	43,6	39	1,56	10 000	6 300	0,85	* **16018**
	140	24	60,5	50	1,96	10 000	6 300	1,15	* **6018**
	160	30	101	73,5	2,8	8 500	5 300	2,2	* **6218**
	190	43	151	108	3,8	7 500	4 800	4,95	* **6318**
	225	54	186	150	5	6 700	4 300	9,8	**6418**
95	120	13	19,9	22,8	0,93	11 000	6 700	0,3	**61819**
	130	18	33,8	33,5	1,34	10 000	6 300	0,61	**61919**
	145	16	44,9	41,5	1,63	9 500	6 000	0,89	* **16019**
	145	24	63,7	54	2,08	9 500	6 000	1,1	* **6019**
	170	32	114	81,5	3	8 000	5 000	2,65	* **6219**

Engineering Drawing



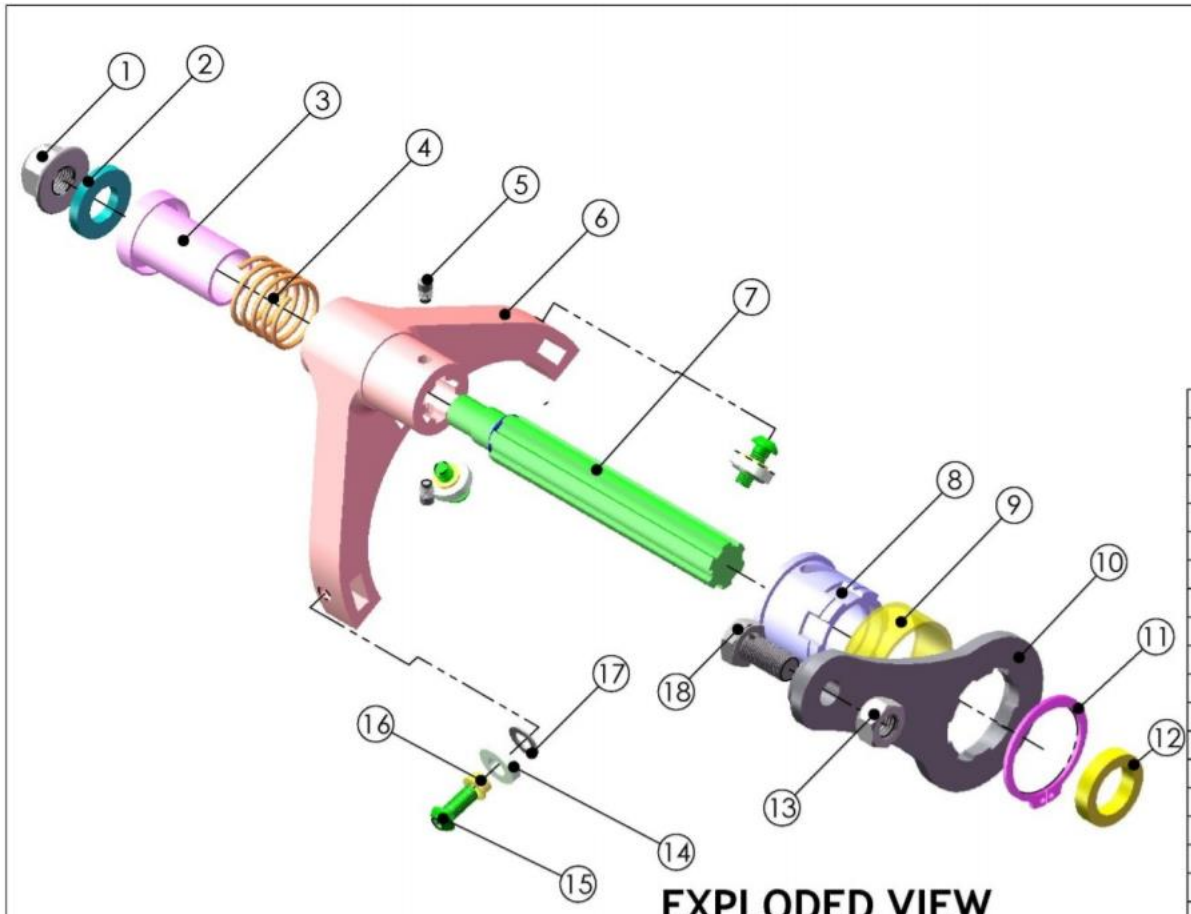
Engineering Drawing



ISOMETRIC VIEW

FACULTY OF MECHANICAL ENGINEERING UNIVERSITI TEKNOLOGI MALAYSIA	DRAWN BY	MOHD SALMAN BIN CHE KOB	DATE	24/04/09	TITLE SHIFTER CONTROLLER CVT MECHANISM
	CHECKED BY	PM. DR. KAMARUL BAHARIN TAWI			
	APPROVED BY	PM. DR. KAMARUL BAHARIN TAWI	DIMENSIONS IN mm		DWG NO: CVT-09-A6 SHEET 6 of 23
DESIGN & DEVELOPMENT OF A CVT FOR MODENAS KRISS 110 CC MOTORCYCLE		SCALE 1:1.5 A4	TOLERANCES EXCEPT WHERE OTHERWISE STATED: LINEAR = ± 0.5 ANGULAR = ± 0.1		WEIGHT: - MATERIAL : - QTY: 1

Exploded View



EXPLODED VIEW

NO	DESCRIPTION	QTY
1	Torque nut-ISO 12126-M12x1.25-S	1
2	Washer	1
3	Spacer	1
4	Spring	1
5	Pin	1
6	Shift fork	1
7	Shifter shaft	1
8	Groove mechanism	1
9	Sleeve	1
10	Shift lever	1
11	Circlip	1
12	Spacer lever	1
13	Torque nut ISO 7719 M10-S	1
14	Roller	3
15	Head screw ISO 7380 M6 x 12s	3
16	Roller bearing	3
17	Washer ISO 7416-12	3
18	Hex screw ISO 8076 M10x1.0x20-S	1

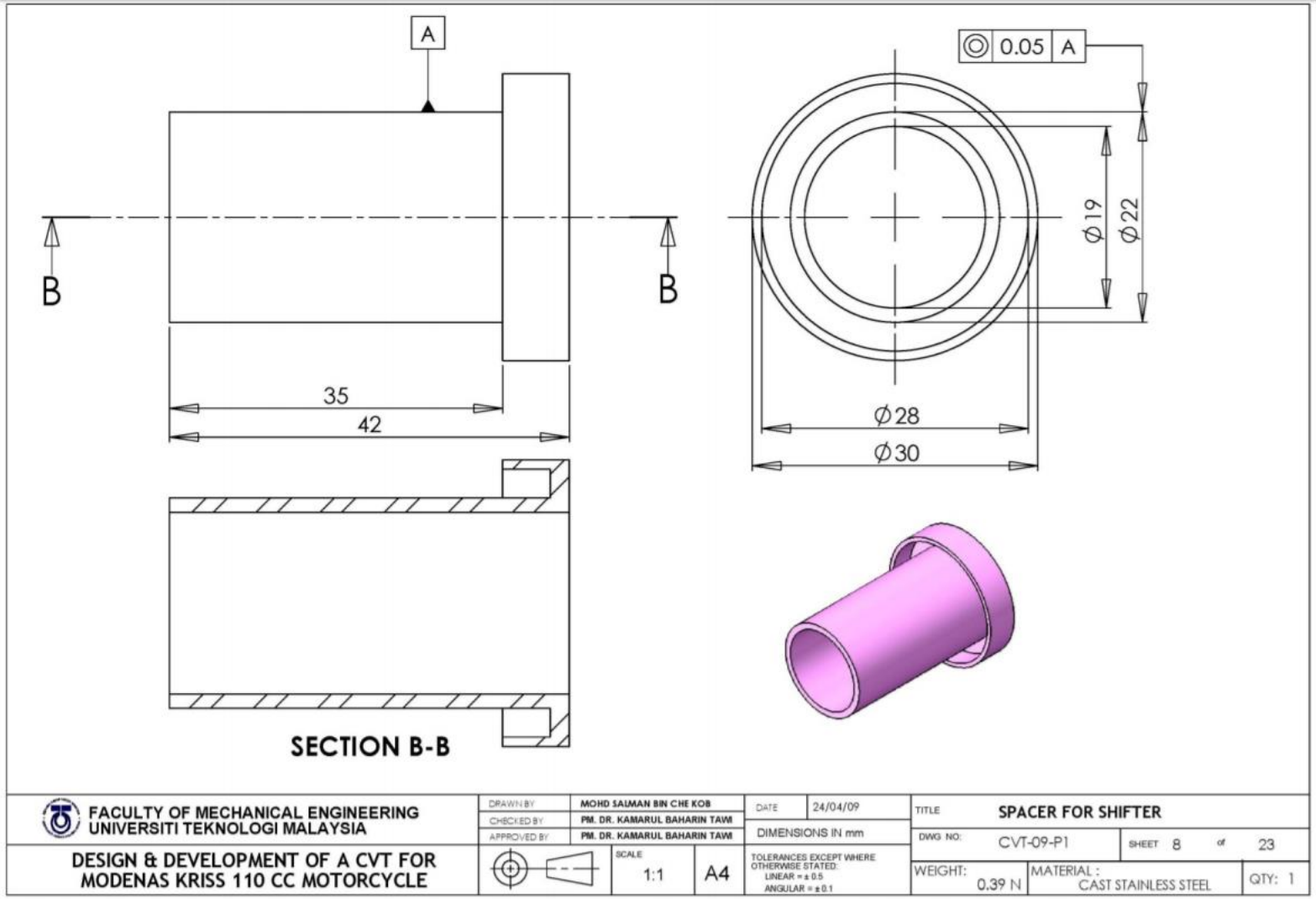
FACULTY OF MECHANICAL ENGINEERING
UNIVERSITI TEKNOLOGI MALAYSIA

DESIGN & DEVELOPMENT OF A CVT FOR MODENAS KRISS 110 CC MOTORCYCLE

DRAWN BY: MOHD SALMAN BIN CHE KOB
CHECKED BY: PM. DR. KAMARUL BAHARIN TAWI
APPROVED BY: PM. DR. KAMARUL BAHARIN TAWI
DATE: 24/04/09
DIMENSIONS IN mm
SCALE: 1:2
A4
TOLERANCES EXCEPT WHERE OTHERWISE STATED:
LINEAR = ± 0.5
ANGULAR = ± 0.1

TITLE: SHIFTER CONTROLLER CVT MECHANISM
DWG NO: CVT-09-A7
SHEET 7 of 23
WEIGHT: -
MATERIAL : -
QTY: 1

Drawing every part



Bill of material

- A **bill of materials** or **product structure** (sometimes **bill of material**, **BOM** or **associated list**) is a list of the raw materials, sub-assemblies, intermediate assemblies, sub-components, parts and the quantities of each needed to manufacture an end product.

Presentation Day with External Examiners

- Theme: Product presentation
- Will be evaluated by industrial panel
- Open to public
- Make sure product is ready to be fabricated

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Thank You
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